MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Permitting and Compliance Division
Water Protection Bureau
P.O. Box 200901
Helena, MT 59620-0901

Permit Fact Sheet
Montana Ground Water Pollution Control System (MGWPCS)

Permittee:	Hungry Horse Development Partners LLC.
Permit No.:	MTX000193
Receiving Water:	Class I Ground Water
Facility Information	
Name:	Hungry Horse Wastewater Treatment Plant
Mailing Address:	P.O Box 2609 Columbia Falls, MT 59912
Contact:	Stephen Byrd
Phone:	509-998-4523
Fee Information	
Number of Outfalls:	1
Outfall - Type:	001 – Infiltration/Percolation Cell

I. Permit Status

This is a new permit for the proposed hungry horse wastewater treatment system as part of a new subdivision in Hungry Horse, MT. The proposed subdivision is located east of the confluence of the Flathead River and the South Fork of the Flathead River. The Department received the permit application and supporting documents on January 31, 2007. The application was determined to be complete on June 21, 2007.

II.Facility Information

A. Facility Description

The proposed Hungry Horse Development (HHD) wastewater treatment system will treat domestic wastewater from the proposed HHD and the existing community of Hungry horse. HHD will consist of a primary school, residential dwellings and commercial buildings. Effluent includes gravity effluent mains that will transport wastewater from each residence, business and

school to a centralized wastewater treatment system. Wastewater influent to the wastewater treatment facility is screened to remove solids. Influent is then treated in anoxic and aerobic treatment tanks. Wastewater is then conveyed to one of two anoxic treatment tanks where nitrogen compounds are broken down and initial bacteria treatment occurs. Wastewater is then pumped to one of two aeration tanks where wastewater undergoes carbonaceous oxidation and nitrification. From this point wastewater will be conveyed to one of two, Membrane Bioreactors (MBR). In the MBR additional carbonaceous oxidation and nitrification occurs. Wastewater is then subject to disinfection via ultraviolet treatment. After treatment in the MBR facility wastewater will be conveyed to two 5,000 gallon dosing tanks. Infiltration Percolation (IP) bed will be dosed to allow for optimal treatment. The wastewater treatment system will have the capacity to discharge a daily maximum of 300,000 gpd (design capacity) to the groundwater.

The proposed permit authorizes discharge of residential strength wastewater to one (1) IP cell which will then discharge to ground water. The drainfield is down-gradient hydraulically, and on the west side of the proposed subdivision. The discharge point from the dosing tanks and pump stations are identified as Outfall 001. This outfall will be located approximately 1.0- 2.0 feet below the ground surface. Outfall 001 is located at N 48º 22' 55" latitude and W 114º 03' 28" longitude situated in T 30N, R 19W, Section 8.

B. Effluent Characteristics

The wastewater treatment system is new therefore no effluent samples have been collected or analyzed. HDR Engineering submitted effluent quality data from similar facilities in Montana and other states. The effluent quality data of these MBR facilities is listed in Table 1.

Table 1. Effluent Quality

Parameter	Maximum	Minimum	Units
Nitrate +Nitrite	7.5	5.0	mg/L
Phosphorous	1.0	0.5	mg/L
Biological Oxygen Demand	10.0	5.0	mg/L
Ammonia	1.0	0.5	mg/L
Total Kjeldahl Nitrogen	3	2	mg/L
Escherichia Coli	20.0	1.0	Organisms/ 100ml

III. Proposed Technology Based Effluent Limits

A level II system must provide at least a 60 % removal of total nitrogen in raw wastewater or produce effluent with a total nitrogen concentration of 24 mg/L or less [ARM 17.30.702 (11)].

The applicant submitted "Anticipated Influent Wastewater Characteristics" (HDR 2007) from a like facility, and reported an annual average Total Nitrogen (TN) concentration of 35 mg/L. The applicant also submitted information reporting effluent concentrations of Nitrate plus Nitrite of 7.5 mg/L and Ammonia concentration of 1.0 mg/L. TN is the sum of Nitrate, Nitrite and

Ammonia. The percent of TN removal is calculated from the difference between raw sewage influent TN concentration and the effluent TN prior to discharge divided by the influent TN concentration multiplied by 100.

$$75.5\%\ removal = \frac{35.0\ mg/L - 8.5\ mg/L}{35.0\ mg/L} \times 100$$

Based on data submitted to the Department by the applicant this effluent is expected to receive at least 60% reduction of Total Nitrogen. This is more stringent than the 24 mg/L required in ARM 17.30.702 (11). Therefore a value of 8.5 mg/L will be used as a permit effluent limit. The technology-based permit limit for total nitrogen will be set at 8.5 mg/L (see Table 1).

The proposed technology based effluent limits for outfall 001 are presented in Table 1.

Table 1. Technology Based Effluent Limit for Outfall 001

Parameter	Concentration (mg/L) Daily Maximum (1)
Total Nitrogen as N	8.5

(1) See definitions, Part I.A of the permit

IV. Water-Quality Based Effluent Limits

A. Receiving Water

The receiving water for outfall 001 is ground water. According to the geologic maps of the surface stratigraphy and well logs in the area the first water bearing zone of the aquifer is comprised of glacial outwash, consisting primarily of stratified gravel, sand, silts and imbricated cobbles. The principal water-bearing zone is varied across the site. Static water levels of wells used to triangulate ground water flow direction as reported by the Applied Water Consulting and the Ground Water Information Center (GWIC) indicate static water level at ranging from 69.0 to 75.6 ft. (GWIC wells 227082, 227075, 227076 and 227077). Water levels measured in all wells indicated a seasonal fluctuation in the wells of approximately 5 ft. Well logs indicate some confining conditions in the aquifer from 160-200 ft. However this is well below the first water bearing zone.

Aquifer tests were conducted by Applied Water Consulting. The estimated transmissivity (T) of the aquifer is 224,150 ft^2/day. This estimate was derived from a pump tests conducted in GWIC well 270775 (completed cross-gradient of the proposed discharge, in the shallowest aquifer). The first aquifer test was comprised of a 24 hour, step draw down test (September 19, 2006). The second test was a 24 hour constant rate pumping test (September 20, 2006). GWIC well numbers (227077 and 227076) were used as observation wells. Applied Water Consulting determined hydraulic gradient and groundwater flow direction to be 0.00042 ft/ft and N 65°W respectively. This information was submitted to the Department as supplemental permit application materials. The four wells used to make these determinations (GWIC wells 227082,

227075, 227076 and 227077) are all within 1,500 ft of the site. This includes MW-1 (northern most well, GWIC 227082), MW-2 (eastern most well, GWIC 227076), MW-3 (southern most well, GWIC 227077) and Irrigation well (GWIC 227075) all of which are located immediately around the proposed discharge.

The permittee submitted ground water analytical data from four wells. The results from the up gradient well (eastern most well, GWIC well 227076) are listed in table 2. Sampling was conducted on July 20, 2006, November 9, 2006 and March 8, 2007.

Table 2. Ground Water Monitoring Results or the Receiving Water

Well Identification	Date Samples	Nitrate	Nitrite	Chloride	Total Dissolved Solids	Conductivity (umhos/cm)
GWIC 227076	July 20, 2006	0.13	0.01	0.5	158	282
GWIC 227076	November 9, 2006	0.18	<0.01	0.5	141	277
GWIC 227076	March 8, 2007	0.17	<0.01	1.0	151	218
GWIC 227076	August 22, 2007	0.16	<0.01	0.5	141	271

Sampling events yielded specific conductivity values of 282, 277, 218 and 271 umho/cm. Therefore, the receiving water for Outfall 001 is Class I ground water (ground water with specific conductance equal to or less than 1,000 microSiemens/cm) as defined by the Administrative Rules of Montana [ARM 17.30.1006 (1)(a)]. Class I ground water is to be maintained for the following beneficial uses with little or no treatment: public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Water quality human health standards (DEQ-7, February 2006) apply to concentrations of substances in Class I ground waters. Pursuant to ARM 17.30.1006(1)(b)(ii) for parameters that are not listed in DEQ-7, there shall be no increase in Class I receiving water concentrations to levels that render the water harmful, detrimental or injurious to the beneficial uses listed for Class I waters. The Department may use any credible information to determine these levels. Class I ground waters are considered high quality waters and are subject to Montana's Nondegradation Policy [75-5-303, Montana Code Annotated (MCA)].

Based on proximity, the nearest surface water is the South Fork of the Flathead River located approximately 2,000 ft up-gradient of the drainfields. The closest surface with respect to the drainfields and ground water movement is the Flathead River approximately 6,750 ft down gradient of the proposed discharge. This distance value will be used to determine nonsignificancant changes in water quality with a phosphorous breakthrough calculation.

B. Basis for Water Quality based Effluent Limits

The Montana Water Quality Act states that it is unlawful to cause pollution, as defined in 75-5-103, of any state waters, to place or cause to be placed any wastes where they will cause pollution of any state waters. The Department is required to clearly specify in any permit the limitations imposed as to the volume, strength, and other significant characteristics of discharges to state waters [75-5-402(3), MCA].

Water quality limitations must be established in permits to control all pollutant or pollutant parameters that are or may be discharged at a level which will cause an excursion from any state water quality standard. The permittee must comply with Montana Numeric Water Quality Standards included in Circular DEQ-7 (February 2006) and protection of beneficial uses (ARM 17.30.1006). Ground water quality standards may be exceeded within a Department authorized mixing zone, provided that all existing and future beneficial uses of state waters are protected (ARM 17.30.1005).

C. Nitrate

Class I ground water is considered high quality water and is subject to Montana's Nondegradation Policy 17.30.705. The proposed wastewater system is considered a new or increased source as pursuant to ARM 17.30.702 (18)(a). The applicable ground water standard, a nitrate concentration of 7.5 mg/L at the end of the proposed standard mixing zone is based on nondegradation rules [ARM 17.30.715 (1)(d)(iii)]. No mixing zone was requested therefore no mixing zone is being considered. The total Nitrogen limit will be set at 7.5 mg/L

Total nitrogen is the sum of inorganic nitrogen and organic nitrogen concentration (nitrate + nitrite as N (NO_3+NO_2-N) plus ammonia and organic nitrogen as N). These effluent limits ensure the nitrate plus nitrite (as N) concentration at the end of the ground water mixing zones are at or below the nondegradation significance criterion of 7.5 mg/L.

D. Phosphorus

Phosphorus is removed mainly through soil sorption processes, which vary based on soil composition. The 50-year breakthrough nondegradation criterion is based on the amount of soil available to adsorb the average load of phosphorus from the wastewater source, between the discharge point and the closest downgradient surface water. The total phosphorus limitations are imposed to ensure that the quality of the effluent meets the nondegradation limit prior to discharge into any surface water [ARM 17.30.715(1)(e)]. Phosphorous breakthrough analysis calculations are mass based, therefore the limit will be a load based discharge limit.

Using the distance to the receiving surface water (Flathead River) approximately 6,750 feet north and down gradient of the proposed drainfield and a phosphorous load value of 0.7 lbs/yr per house hold the breakthrough time for phosphorus is 115.5 years. The phosphorous load is based on the decreased phosphorous concentrations expected from the advanced treatment system. The breakthrough time of 115.5 years is considered nonsignificant pursuant to Montana's Nondegradation criteria [ARM 17.30.715(1)(e)].

A phosphorous breakthrough would occur in 50 years (the level of significant degradation) at an effluent load of 0.005 lbs/day or 1.7 lbs/year. To derive a concentration of phosphorous from a load, load (lbs/day) is divided by the product of flow (the design capacity, 300,000 gpd) and 8.34^{-6}.

$$\frac{0.005\ lbs\ /\ day}{300,000\ gpd\ \times 8.34^{-6}(lb\ /\ g)/(mg\ /\ l)} = 0.002\ mg\ /\ l$$

Therefore the effluent limit for the Total Phosphorous load discharged to the drainfield shall not exceed 0.002 mg/l or 0.005 lbs/day or 1.7 lbs/year for Outfall 001. The water quality based effluent limit for outfall 001 will therefore be set at 0.002 mg/l and 0.005 lb/day.

E. Escherichia Coli

An Escherichia Coli (E coli) limit has been established in this permit due to the following site-specific criteria:

- The permittee has not requested a mixing zone, thereby facilitating the need for water quality standards to be met at the end of pipe prior to discharge to state waters.
- The volume of wastewater being discharge is significantly larger than typical ground water discharges.

No Mixing Zone will be granted for pathogens.

The proposed water quality base nondegradation based and human health standards of DEQ-7 effluent limits for outfalls 001 are presented in Table 3.

Table 3. Proposed Water-Quality Effluent Limits for Outfalls 001

Parameter	Units	Concentration Daily Maximum (1)	30 Day Average Load (2) (lbs/ per day)
Total Nitrogen as N	mg/L	7.5	18.77
Total Phosphorus as P	mg/L	0.002	0.005
E Coli	Organizims/100 ml	< 1	NA

(1) See definitions, Part I.A of the permit
(2) 30 day average load calculation: lb/d = (mg/L) x flow (gpd) x 8.34 x 10^{-6}

F. Mixing Zone

The permittee has proposed to discharge all wastewater from Outfalls 001 to ground water. Ground water in the immediate vicinity of the discharge is classified as class I water as defined by ARM 17.30.1006 (1)(a) and discussed in section IV A of this document. The permittee did not request a source specific or standard 500-foot ground water mixing zone for outfall 001. Information submitted with the permit application regarding performance standards of the

wastewater treatment system indicated that effluent will be treated to below water quality standards prior to discharge. A ground water mixing zone will not be granted for any parameter.

V. Final Effluent Limits

The proposed final effluent limitations for Outfall 001 summarized in Table 4 and are based on the more restrictive of the technology based effluent limits, the water quality based effluent limits and the water quality standards of DEQ-7.

Class I ground water is to be maintained for the following beneficial uses with little or no treatment: public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Water quality human health standards (DEQ-7, February 2006) apply to concentrations of substances in Class I ground waters. Pursuant to 75-5-402 (3), ARM 17.30.1031(2) and ARM 17.30.1006 (1)(a) the Department will implement limits such that the discharge from outfall 001 shall not cause increase of a parameter to a level that renders the water harmful, detrimental or injurious to the beneficial uses listed for class I water.

The permittee submitted technical information indicating a design capacity of 300,000 gpd. The design flow is the peak flow (daily or instantaneous) for sizing hydraulic facilities, such as pumps, piping, storage and adsorption systems and means the average daily flow for sizing other treatment systems. This value is used in calculations for phosphorous load limits and for calculations for determining the allowable nitrogen concentration at the end of the mixing zone. The combined flow limit from outfalls 001 shall not exceed the design capacity of 300,000 gpd based on the daily average.

Table 4. Final Numeric Effluent Limits for Outfall 001

Parameter	**Units**	**Concentration Daily Maximum (1)**	**30 Day Average Load(2) (lbs/ per day)**
Total Nitrogen as N	mg/L	7.5	18.77
Total Phosphorus as P	mg/L	NA	2.5
E Coli	Organizims/100ml	<1.0	NA

(1) See definitions, Part I.A of the permit
(2) load calculation: lb/d = concentration (mg/L) x flow (gpd) x 8.34 x 10^{-6}
NA = Not Applicable

VI. Monitoring Requirements

Effluent limits are established to protect the ground water from a change in water quality that would cause degradation [ARM 17.30.715] or limit a beneficial use [ARM 17.30.1006(1)(a)]. Effluent monitoring is essential to ensure the compliance with permit limits, non-exceedence of state water quality standards and effective treatment of the wastewater discharged from the facility. Samples or measurements shall be representative of the volume and nature of the monitored discharge. Water quality monitoring of the effluent shall occur after Ultra violet disinfection and prior to discharge into the IP cells. The permittee shall monitor the flow of the effluent continuously and report the gallons per day based on the daily maximum.

The measurement method shall be either by flow meter and recorder or a totalizing flow meter; dose counts or pump run-times will not be accepted. Flow measurement equipment must have the ability to report a daily maximum flow. To ensure that the Total phosphorous load is calculated correctly, an accurate daily flow must be measured. Daily flow shall be measured when required sampling is conducted (flow measurement must correspond to sample collection to calculate an accurate load). The effluent flow rate is to be a measured and reported as a daily maximum flow and a 30 day average.

The permittee shall monitor the effluent for the constituents in Table 5 at the frequency and with the type of measurement indicated. If no discharge occurs during the entire monitoring period, it shall be stated in a Discharge Monitoring Report that no discharge occurred.

Table 5. Outfall 001 Parameters Monitored in the Effluent Prior to Discharge

Parameter	Frequency	Sample Type[(1)]
Effluent Flow Rate, gpd[(2) (3)]	Daily	Continuous
Biological Oxygen Demand (BOD_5), mg/L	Weekly	Composite
Total Kjeldahl Nitrogen (TKN), mg/L	Weekly	Composite
NO_3+NO_2 as N, mg/L	Weekly	Composite
Total Phosphorus (as P), mg/L	Weekly	Composite
Total Suspended Solids (TSS) mg/L	Weekly	Composite
Total Nitrogen (as N), mg/L	Weekly	Calculated
Total Nitrogen (as N), lb/d	Weekly	Calculated
Total Phosphorus (as P), lb/d	Weekly	Calculated
Chloride, mg/L	Weekly	Composite

(1) See definitions, Part I.A of the permit
(2) If no discharge occurs during the reporting period, "no discharge" shall be recorded on the DMR report form
(3) Permittee is to report the daily maximum and 7 day average

A. Ground Water Monitoring

Pursuant to 17.30.1031, all issued MGWPCS permits must contain special conditions which will assure compliance with the ground water quality standards. These special conditions include, but are not limited to, the self monitoring requirements for each discharge, monitoring well configuration, pollutants to be monitored, frequency of monitoring, recording and reporting and analytical methods to be utilized by the permittee.

Ground water monitoring will be required in this permit due to the following site-specific criteria:

- This area is experiencing rapid growth and development.
- The presence of a high quality receiving water and the need to protect existing and future beneficial uses.
- Proximity of existing wells down gradient of the proposed discharge

- The aquifer is a coarse grained alluvial aquifer with a relatively high hydraulic conductivity.

To ensure that these requirements are met, the permittee will be required to monitor ground water for those parameters in table 6.

Table 6. Monitoring Parameters for Monitoring Wells:

Parameter	Frequency	Sample Type (1)
Static Water Level (SWL) (feet below the casing top)	Quarterly	Instantaneous
Specific Conductance, µmhos/cm	Quarterly	Grab
Chloride, mg/L	Quarterly	Grab
Escherichia Coli (Organisms/100 m*l*)	Quarterly	Grab
Total Kjeldahl Nitrogen (TKN), mg/L	Quarterly	Grab
NO_3+NO_2 as N, mg/L	Quarterly	Grab

(1) See definitions, Part I.A of this permit

VII. Significance Determination

The Department has determined that the discharge constitutes a new or increased source and is subject to Montana Nondegradation Policy (75-5-303, MCA; M 17.30.702(16)). Nitrogen concentrations are predicted to be less than 7.5 mg/L (DEQ nitrate sensitivity analysis 2007). Phosphorus load limits are based on nondegradation significance criteria for 50-year break-through to surface water in accordance with ARM 17.30.715(1)(e) (DEQ phosphorous break through analysis 2007). The Department has determined this discharge to be nonsignificant with respect to nitrogen and phosphorous concentrations discharged to state waters.

VIII. Special Conditions

a) Effluent Flow Measurement

To ensure that the total phosphorous load is calculated correctly, an accurate daily discharge must be measured. Effluent flow shall be monitored following ultra violet disinfection and immediately prior to discharge into the I/P cells as described in section VI. The permittee shall monitor the flow of the effluent continuously. Effluent flow monitoring shall begin upon the effective date of the permit.

b) Monitoring Well Installation

The permittee must install and monitor a minimum of one nested pair of ground water monitoring wells. The nested pair of monitoring wells shall be installed in the center line of outfall 001 on the down gradient edge of the property owned by Hungry Horse Development Partners LLC. The two wells shall be identified as MW-4A and MW-4B. The monitoring wells must be constructed as a nested pair, resulting in two wells in one location. One well, identified as MW-4A, shall be screened from the top of the high water table to 15 feet below the low water table. The second well, identified as MW-4B shall be screened for an additional 15 feet starting from the bottom of the screened interval in MW-4A.

Within 90 days of the effective date of the permit the permittee shall submit to the Department for approval a plan for compliance ground water monitoring well installation as well as a brief summary of a monitoring, sampling and analysis plan for monitoring wells installed onsite. The plan is to include the location, conceptual design and construction methods of the planned ground water monitoring wells, and the monitoring, sampling and analysis methods that will be used to meet the monitoring required in the Permit.

Prior to discharge the permittee shall submit to the Department a brief report or letter documenting the results of the monitoring well installation including the final location of the installed monitoring well, construction details for the well and a report on ground water quality in the well. Ground water quality analysis shall include those parameters listed in Table 6. Ground water quality monitoring shall begin upon installation of the well and continue though the duration of the permit.

IX. Information Source

In the development of the effluent limitations, monitoring requirements and special conditions for the draft permit, the following information sources were used to establish the basis of the draft permit and are hereby referenced:

ARM Title 17, Chapter 30, Sub-chapter 5 - Mixing Zones in Surface and Ground Water, September 1999.

ARM Title 17, Chapter 30, Sub-chapter 7 - Nondegradation of Water Quality, March 2000.

ARM Title 17, Chapter 30, Sub-chapter 10 - Montana Ground Water Pollution Control System (MGWPCS), March 2002

Department of Environmental Quality, Nitrate Sensitivity Analysis, 2007

Department of Environmental Quality Phosphorous Breakthrough Analysis 2007

Environmental Protection Agency, U.S. EPA NPDES Permit Writers Manual, December 1996

Environmental Protection Agency, Design Manual: Onsite Wastewater Treatment System Manual. EPA 625/R-00/008, 2002.

Fetter, C.W., Applied Hydrogeology., 1988

HDR, Inc. MGWPCS permit application submitted to DEQ March 22, 2007

HDR, Inc. MGWPCS Supplemental Permit Application Materials. Received by the Department May 11, 2007

Regensburger, E. Nutrient-Reducing Wastewater Treatment System Designation Form. Montana Department of Environmental Quality. 2004

Woessner, W., Thomas, Troy., Ball, Pat and DeBorde, Dan C., (April 1998), Virus Transport in the Capture Zone of a Well Penetrating a High Hydraulic Conductivity Aquifer Containing a Preferential Flow Zone: Challenges to Natural Disinfection. , University of Montana., Missoula, Montana

Prepared By: Louis Volpe April 3, 2008